BLS Electronics System

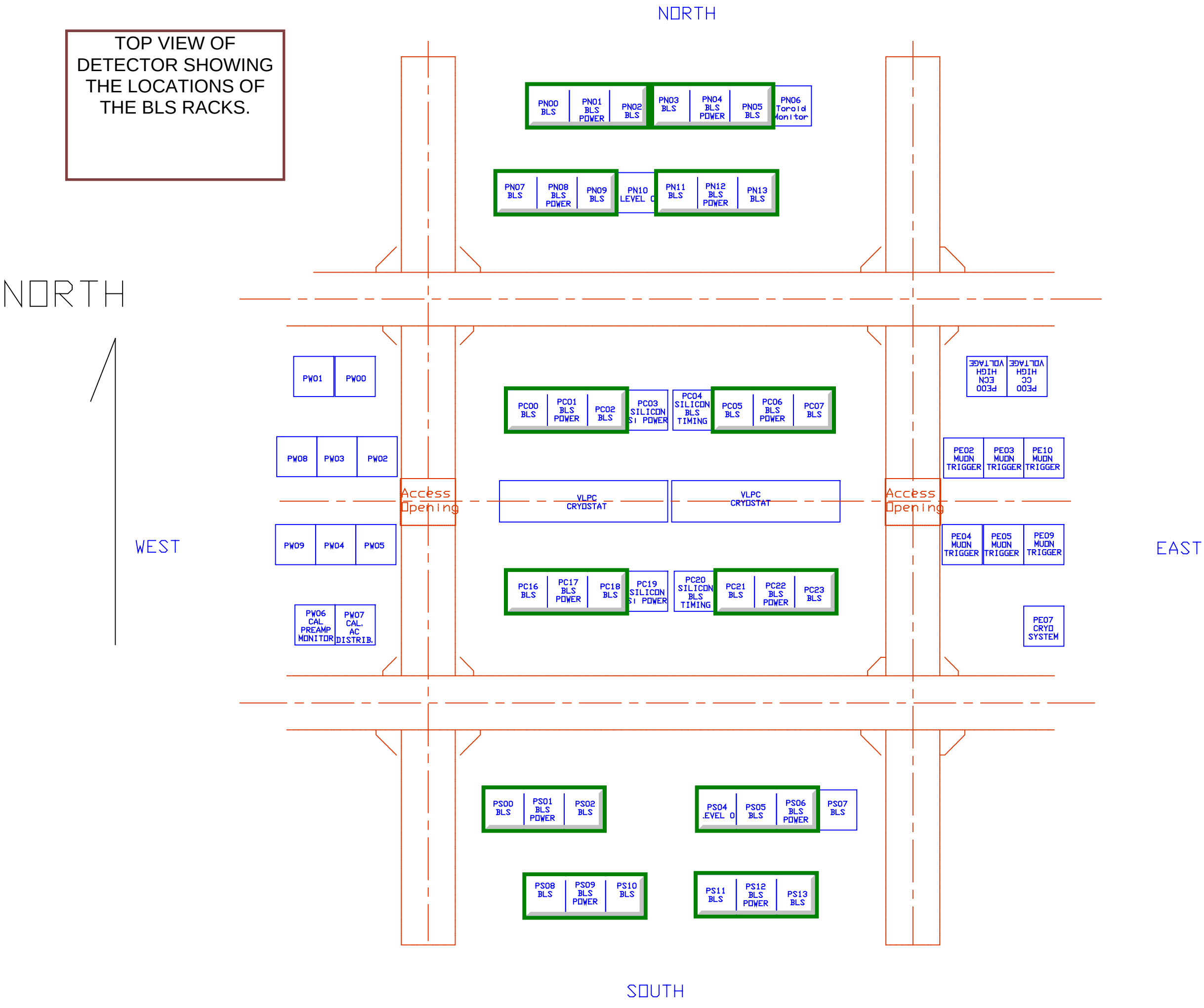
The BLS (Base Line Subtractor) system electrically sits between the Preamps and the ADCs in the Calorimetry electronics. The system has a total of twelve 3-rack units that are located below the cryostat. There are four units in each section, CC, ECN and ECS. Each 3-rack unit contains six BLS crates, three in the left rack and three in the right rack for a total of 72 BLS Crates.
The center rack contains the BLS power supplies, AC distribution and the Calibration Pulser. The three rack system is protected by a conventional smoke detector, VESDA[1], water flow and leak/drip detection. A fault from one of these detectors will disable the power supplies.
Each BLS Crate contains the following Cards

1-Crate Bus Controller Card 3740.412-ED-255715
2-Analog Driver Cards 3740.412-ED-255716
1-Crate Monitor Card 3740.412-ED-255874
16-BLS Cards Stony Brook HEP
1-Crate Bus Terminator Card 3740.412-EC-255711

The BLS Cards are new and documented separately. The BLS card (Motherboard) document provides details of the card and tests conducted to verify the safety aspects of the card. The only other card that is new for the Run II system is the Crate Bus Controller Card. The design of this card is very similar to the Run I Controller Card and has about the same power draw. The card receives and drives signals on one 34-condcutor cable and one 20-conductor cable. It receives digital control signals from the timing and control system. These signals are resynchronized with a precision clock that is used to drive the backplane for the rest of the crate. This card uses +5V and -5.2V for all the logic circuits. There are also connections to the -12V and +13V power, which is used to drive a temperature sensor on the board.
The remaining cards are unchanged from Run I and are referenced here for completeness. The Analog Driver cards are used to drive differential twisted pair cables to the Analog-to-Digital circuitry in the ADC crates. These cards use custom socketed daughter circuits for each channel. The cards use -12V and +13V for the analog circuitry and +5V and -5.2V for the digital control logic. The Analog Driver cards are the only ones to use -12V power.
The Crate Monitor Card is used for crate monitoring. It pulls all the temperature sensor information from the other crate cards together and sends these out via a single connector. There are voltage rail and signal test points on the front panel. The board uses +5V and -5.2V only (for LEDs and some of the driver circuitry).
The Bus Terminator card only connects to the P1 backplane and only connects to the -5V power (via 2 pins). The rest of the connections on this board are to ground.
The BLS Crate will have a new P2 backplane along with a change in the DC power harness as described in this documentation. The P2 back plane construction was designed to handle the fused currents available from the power supply. Information about the design is documented in the BLS Back Plane.

[1] VESDA means "Very Early Smoke Detection Apparatus"

TOP VIEW OF DETECTOR SHOWING THE LOCATIONS OF THE BLS RACKS.



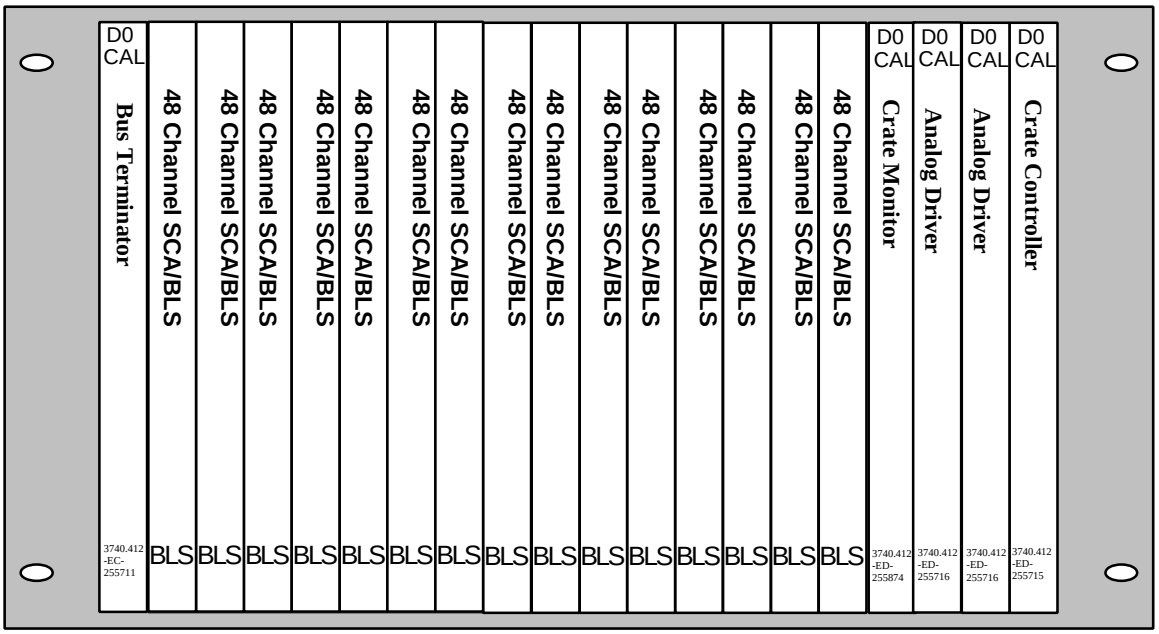
ECNSE

AC from
PANEL 1 Ckts 26/28/30

FRONT VIEW

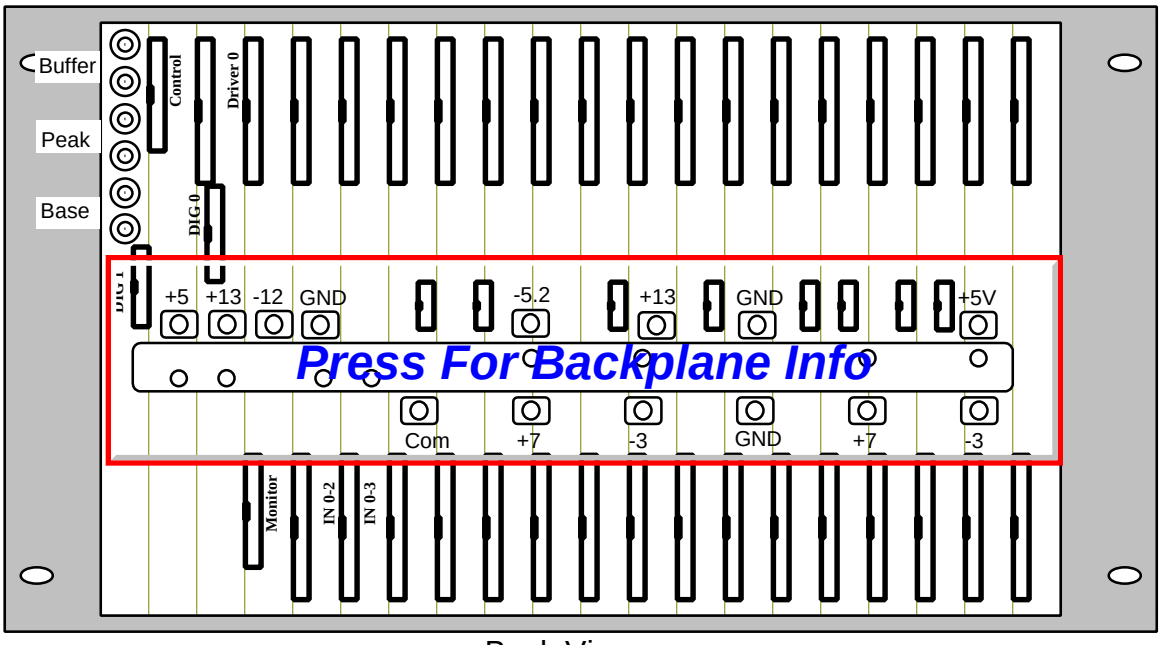
David L. Huffman
6/5/00 11:34 AM

BLS Crate



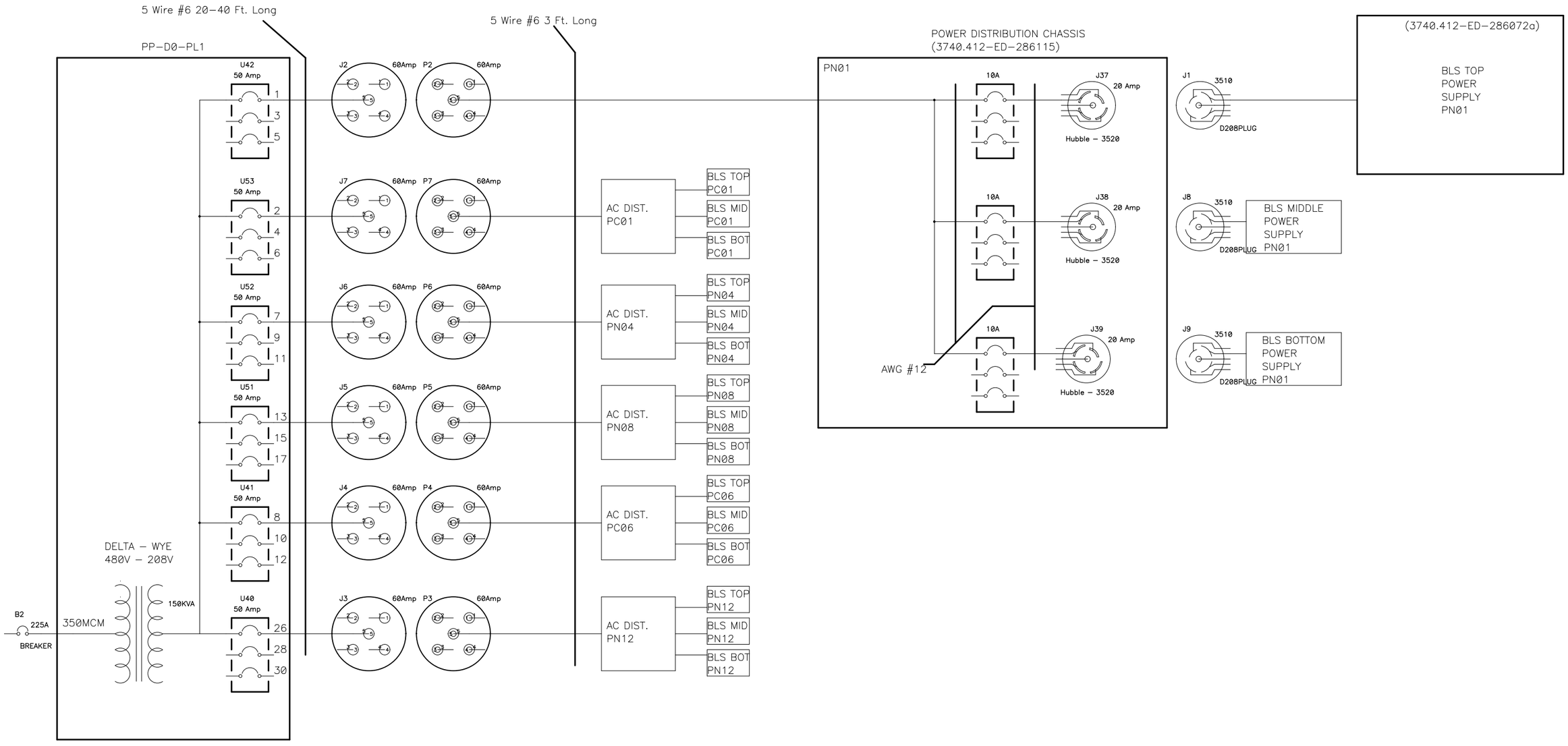
Front View

BLS Crate

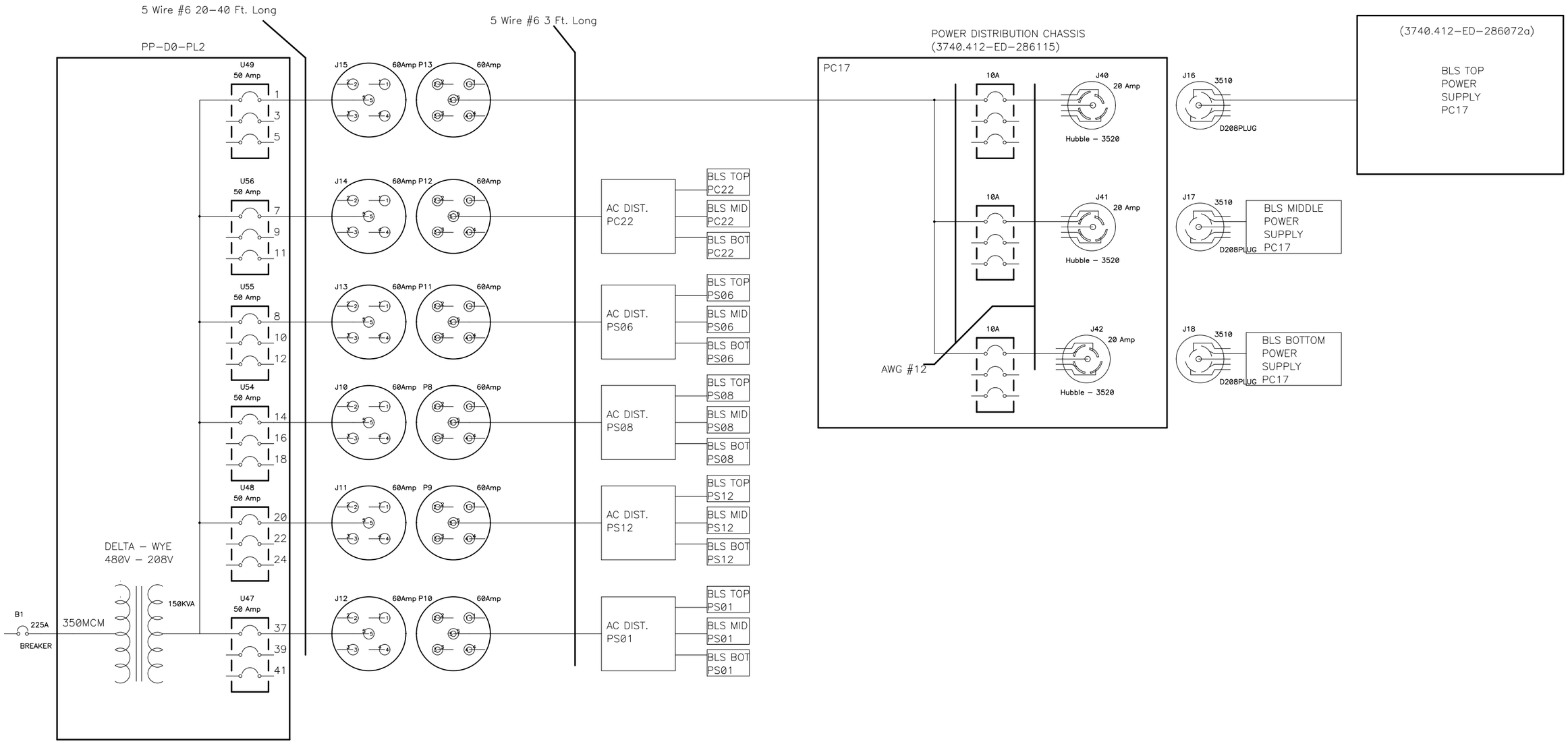


Back View

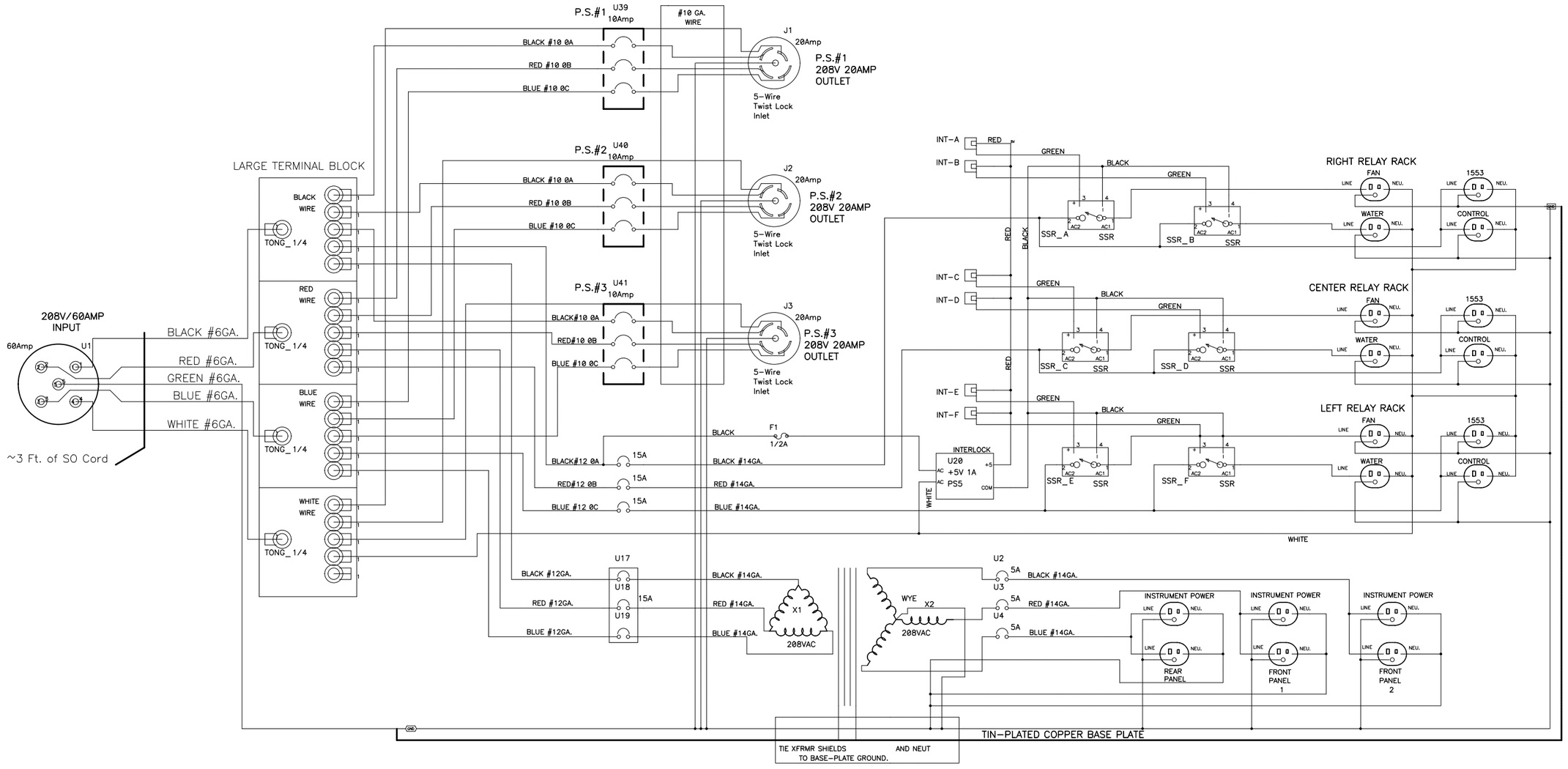
Press for BLS Card Details



Title	14:49:19 Wed May 24 2000 BLS AC DISTRIBUTION		
Size D	Number 3740.412–ED–286241		Rev A
Date	May 24, 2000	David L. Huffman	
Filename	ACDistBLS.SCH	Sheet 1 of 2	



Title	14:49:58 Wed May 24 2000 BLS AC DISTRIBUTION		
Size D	Number 3740.412–ED–286241a		Rev A
Date	May 24, 2000	David L. Huffman	
Filename	ACDistBLS.SCH	Sheet 2 of 2	



Title	14:46:54 Wed May 24 2000 POWER DISTRIBUTION CHASSIS		
Size D	Number 3740.412-ED-286115		Rev D
Date	March 1, 2000	David L. Huffman	
Filename	ed286115a.SCH	Sheet 1 of 1	

BLS Power Supply

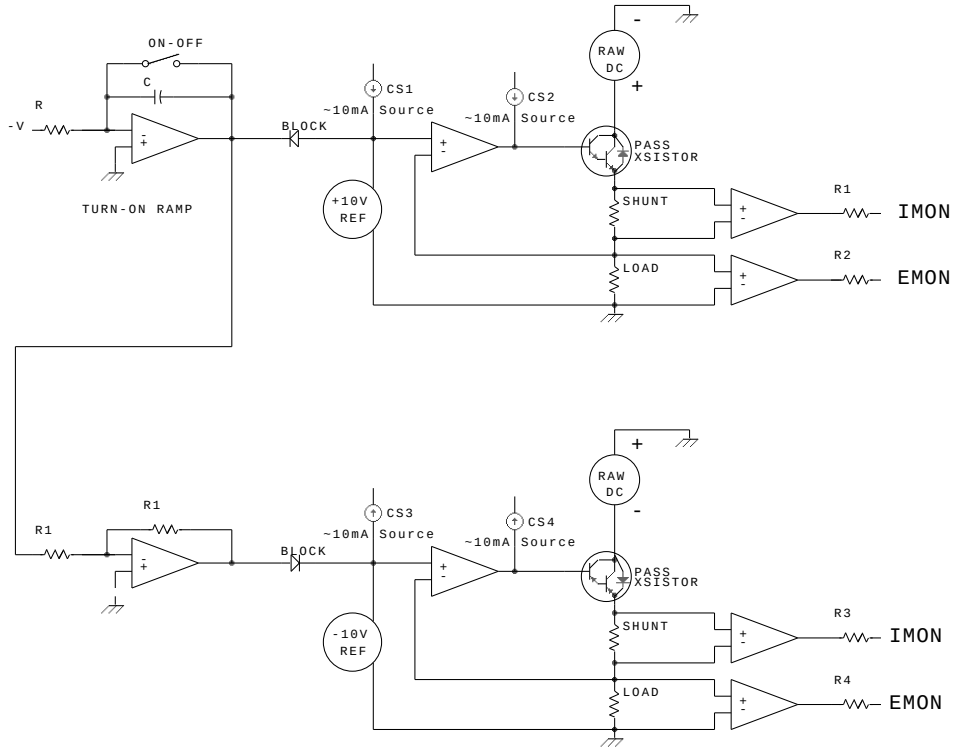
The BLS Power Supply provides power for the BLS Crate electronics. The Run I supplies will be reworked to provide the new electronics with its power requirements. Each BLS supply is a dual unit that powers two electronics crates. The crates are located to the right and left of the supply in the three-rack system. The supply has one common raw DC source used by each half of the unit. Each half is controlled and operated separately.

There are six different voltage outputs supplied to the crate. These are the ratings of each output for each half of the power supply.

- +7V @ 25A
- -3V @ 20A
- +13V @ 20A
- -12V @ 5A
- +5V @ 20A
- -5.2V @ 10A

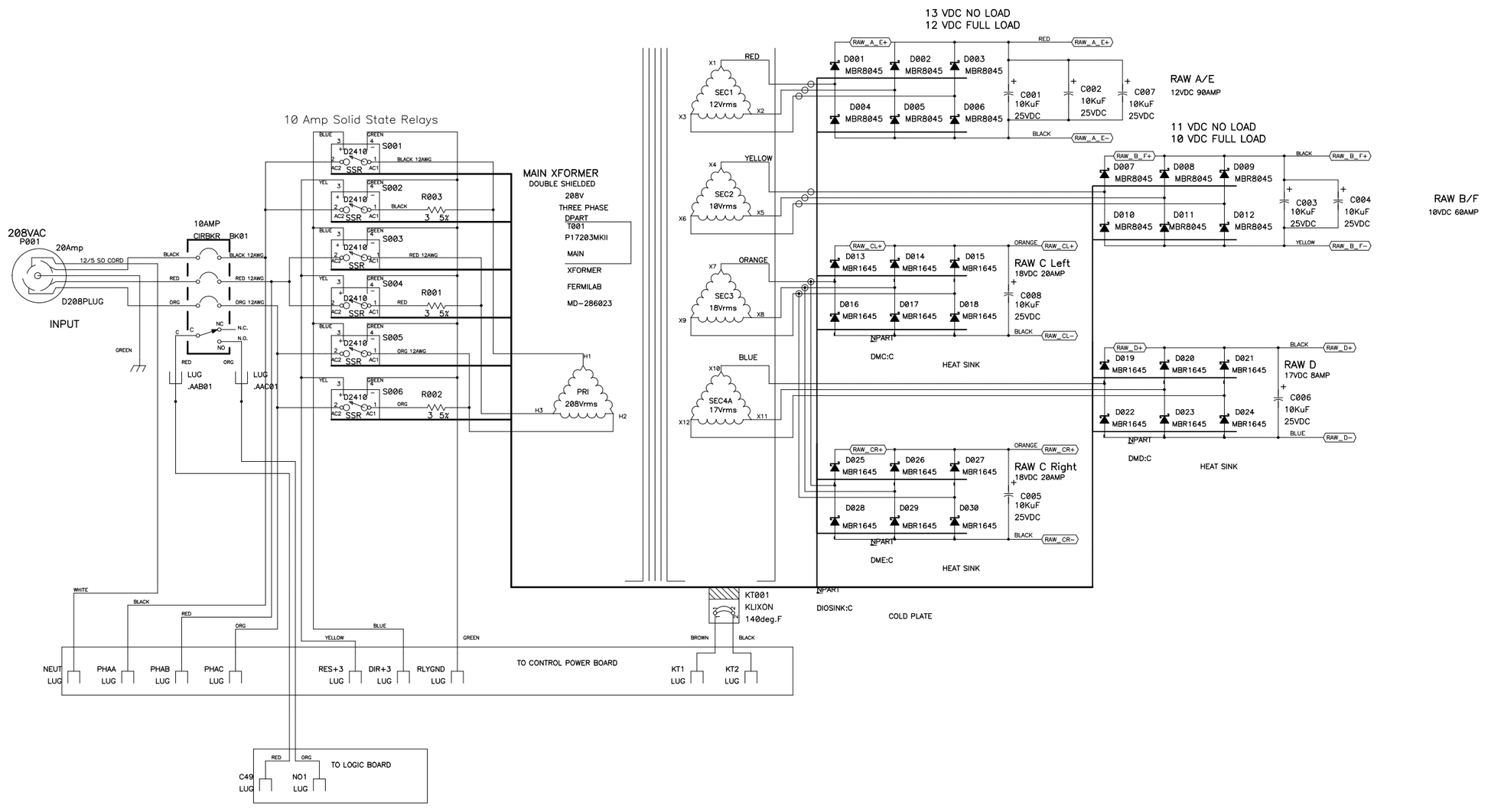
Each output is protected with over current, over voltage and over temperature sensing. In addition each output regulator is fused at its connection point to the raw supply. The AC input (208 3ϕ) has a magnetic breaker rated at 10 Amps. The input AC comes from an AC Distribution box just like the ones used for the Preamp Power Supplies. The only difference is the breaker size, which is 10 Amps.

The supply receives an external signal from the adjacent racks that provide interlocking for water flow, smoke detection and water leaks via drip detectors. Any one of which will signal the supply to disable the high power circuitry, removing 208V 3ϕ current to the raw supply.



TYPICAL COUPLED ± SUPPLIES

FERMILAB	
David L. Huffman	
P.O. BOX 500 BATAVIA IL. 60510	
File: D:\00DATA\SCHEMATI\BLS\BLSBLK P01	
D0 SYSTEM LOW VOLTAGE P.S.	
BLOCK DIAGRAM OF POWER SUPPLY	
REV A	3740.412-ED-286---
DATE: 05/30/97 09:48:01	SHEET 01 OF 01



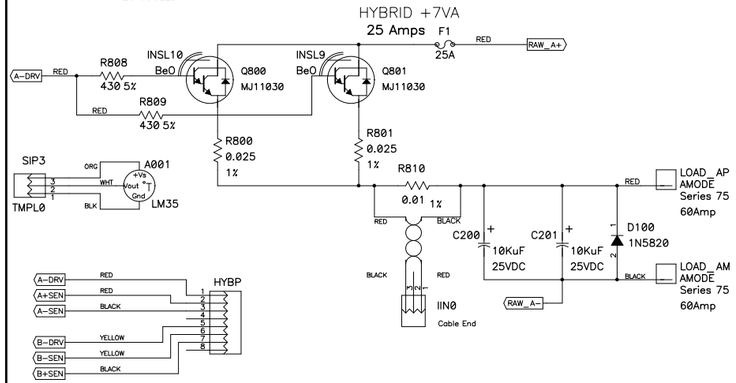
Title	15:35:08 Wed May 24 2000 BLS RAW POWER CIRCUIT
Size D	Number 3740.412-ED-286072a Rev E
Date	Dec. 6, 1999 DAVID L. HUFFMAN
Filename	BLSRAWmkii.SCH Sheet 1 of 4

NPART

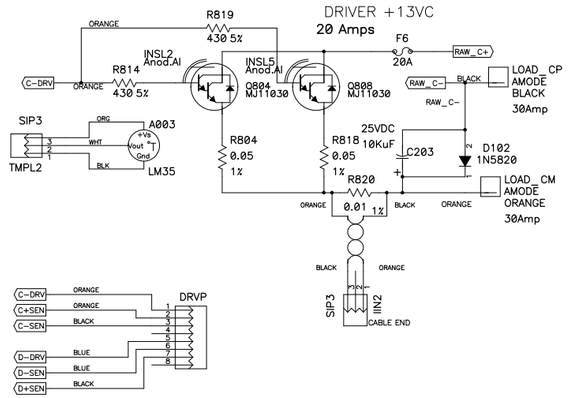
COOLER:C

H2O COOLED

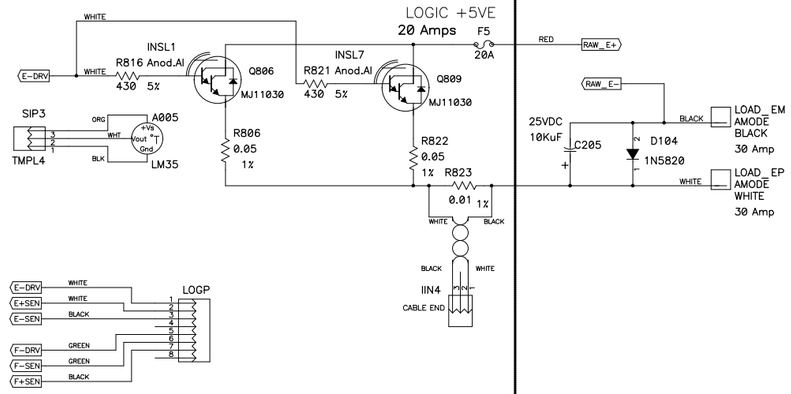
HYBRID +7VA
25 Amps



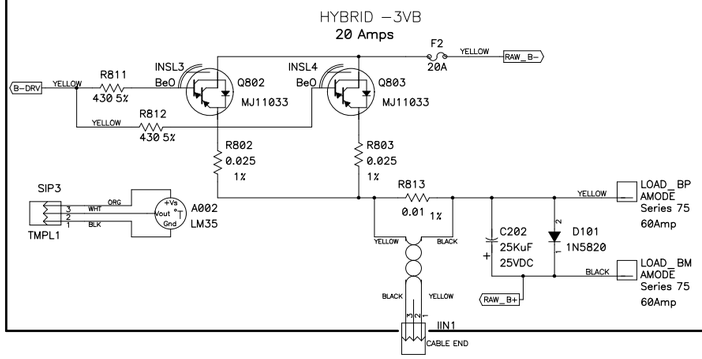
DRIVER +13VC
20 Amps



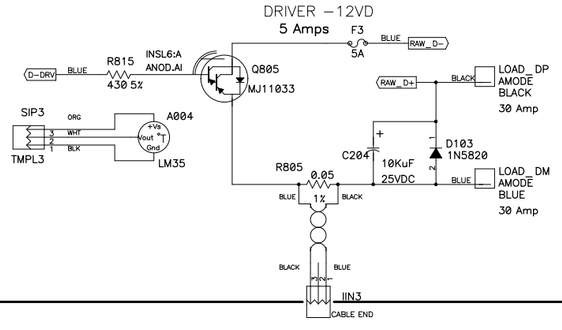
LOGIC +5VE
20 Amps



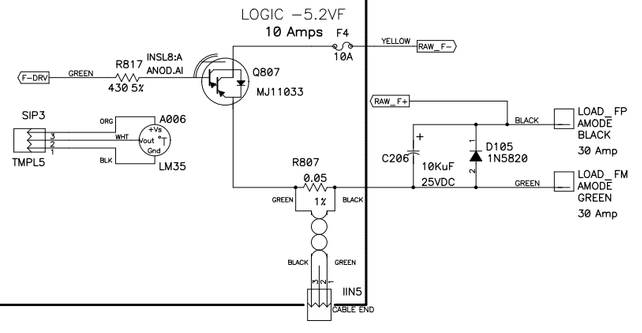
HYBRID −3VB
20 Amps

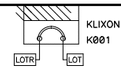


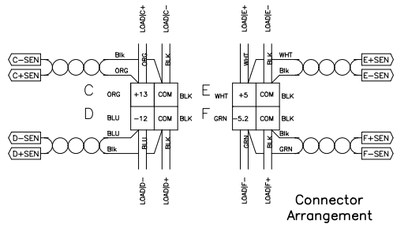
DRIVER −12VD
5 Amps

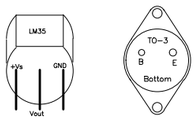


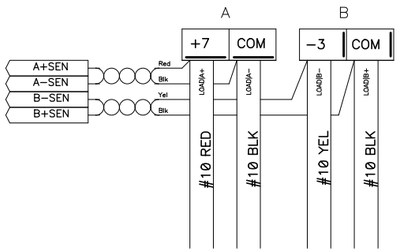
LOGIC −5.2VF
10 Amps











Title	15:32:08 Wed May 24 2000 BLS OUTPUT MODULE		
Size D	Number		Rev Rev G
Date	5/30/97	David L. Huffman	
Filename	BLSOUTMKII.SCH	Sheet	1 of 3

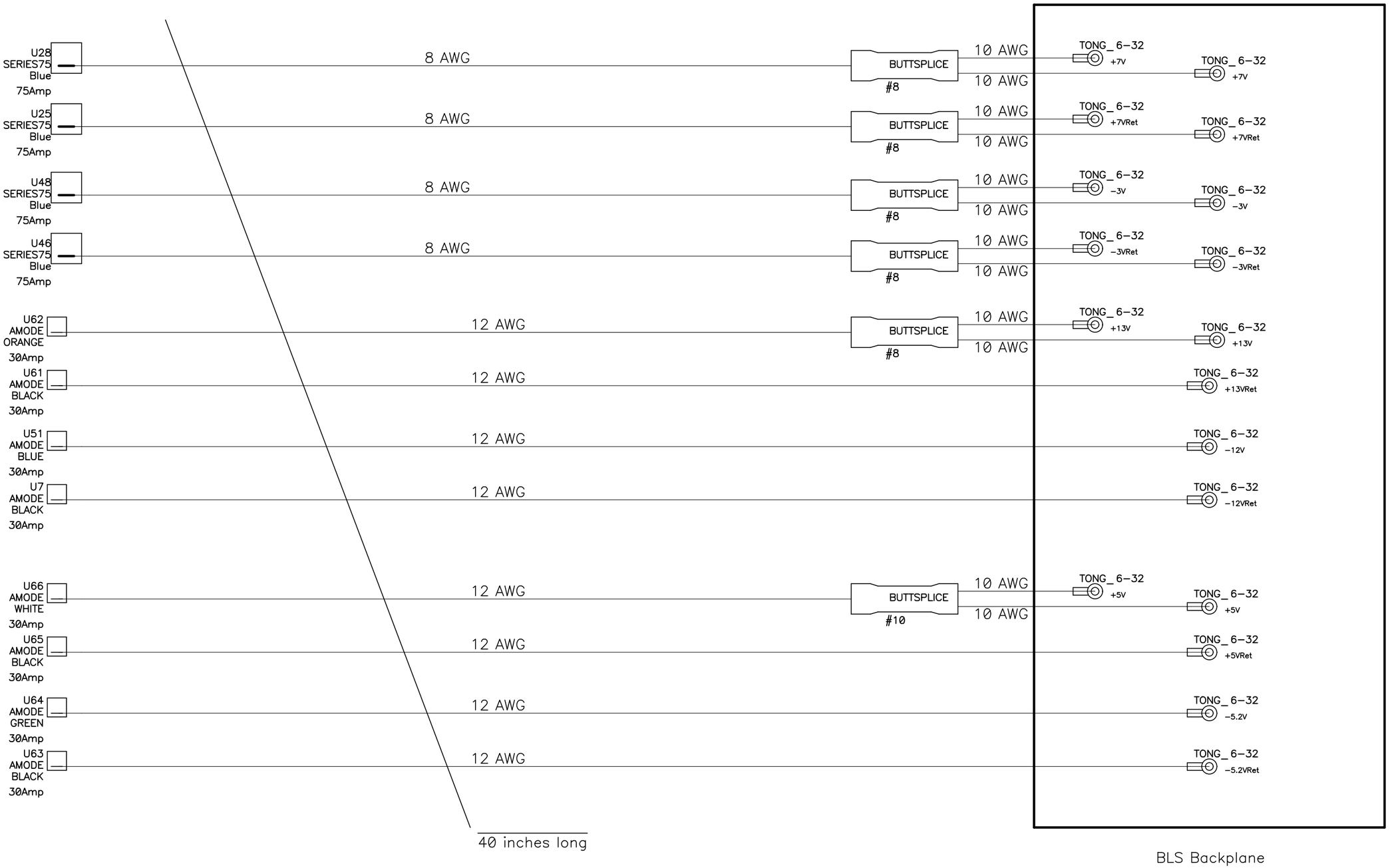
BLS Power Harness Re-Work

The BLS power supply harnesses require some rework to provide for the new P2 backplane. The ground bus will need to have additional holes punched according to the revised drawing 3740.412 MD-286042-A. One extra ground strap will be needed for each crate. Reference drawing 3740.412 MD-286043

To upgrade the power harness, do the following:

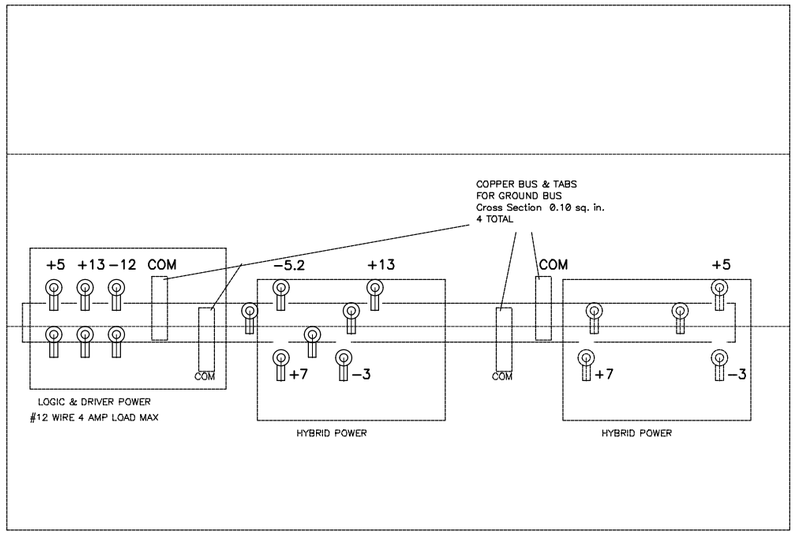
- Remove the cable tie from the crate end of the harness.
- Cut the WHITE and ORANGE wires about 2" before the larger butt splice. Stagger the location so the splice is not on top of each other in the harness.
- Butt splice two 10 AWG WHITE wires (one will be the one just cut off) onto the WHITE wire going toward the power supply end. The length of the additional wire will be determined by the type of harness being modified. There are right and left handed harness types.
- Repeat the above operation for the ORANGE wire.
- You will now have two wires for the +5V and +13V power bug connection on the new backplane.
- All hardware on the ground bus should be brass! Replace any stainless steel hardware with brass.

After modification the harness can be installed on the appropriate BLS crate.

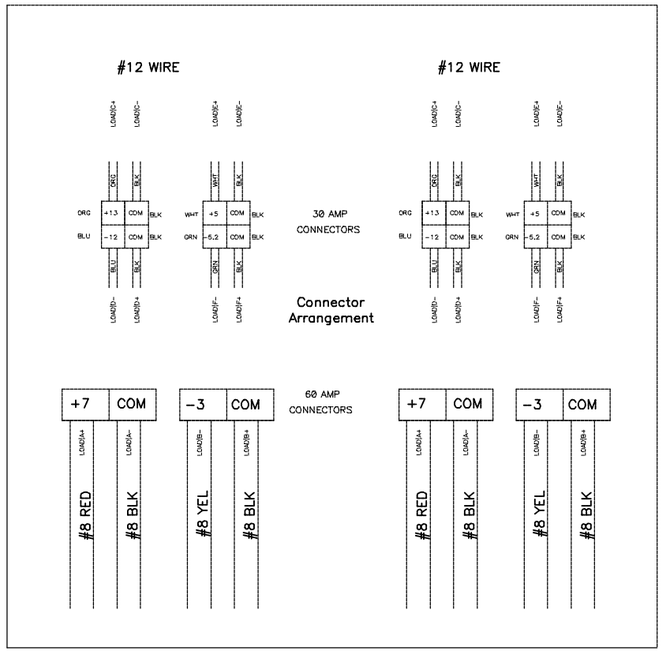


TYPICAL FOR EACH HALF OF THE POWER SUPPLY.

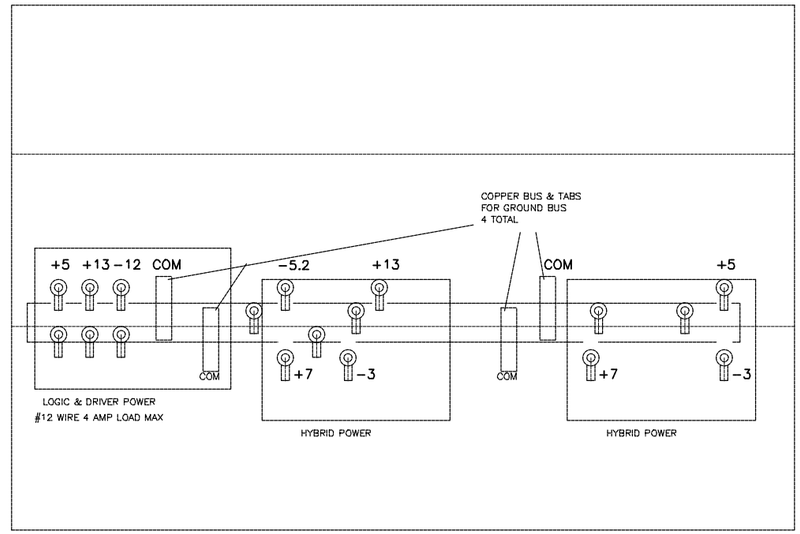
BLS ELECTRONICS CRATE

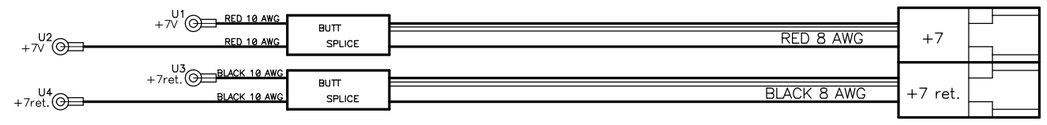


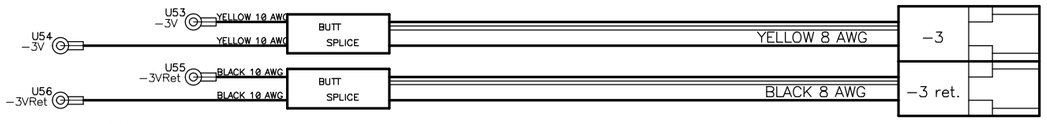
BLS LOW VOLTAGE POWER SUPPLY

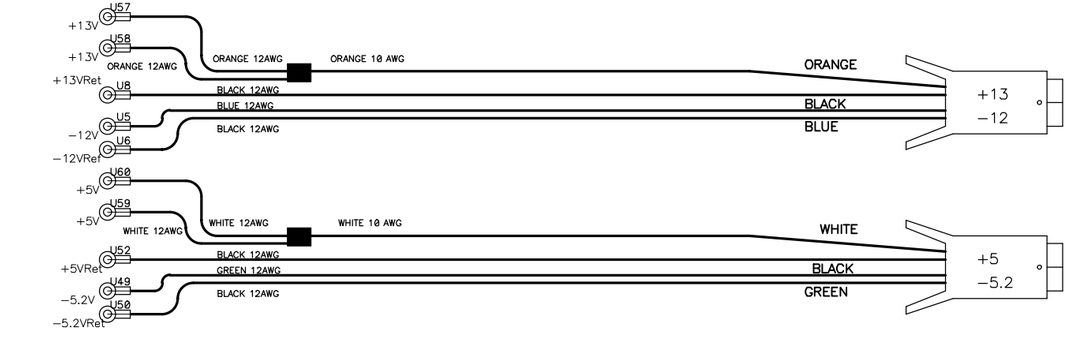


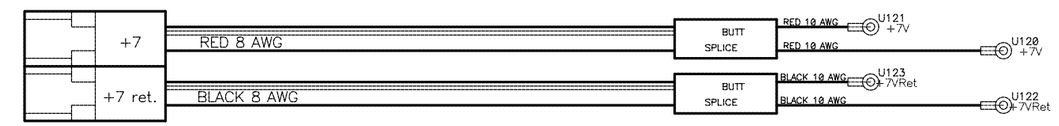
BLS ELECTRONICS CRATE

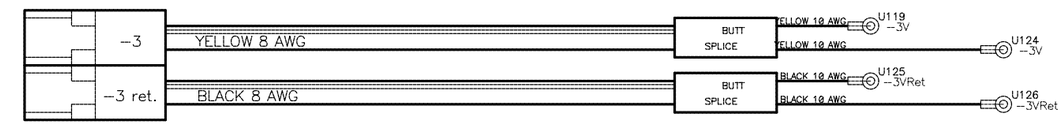


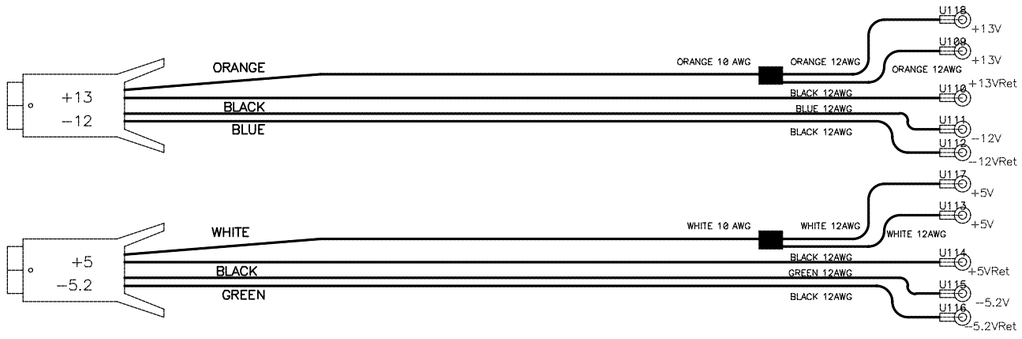












Title	14:33:54 Mon Jul 03 2000 BLS Crate Wiring		
Size D	Number 3740.412−ED−286068		Rev B
Date	Jan. 11, 2000	David L. Huffman	
Filename	BLSOUTW.SCH	Sheet 1 of 3	

INTRODUCTION

This section describes the rack protection system implemented in the BLS racks at Dzero. These racks are located on the North, Center, and South platform.

The reader should be familiar with the Dzero Rack Monitor Interface Chassis and the Dzero AC Distribution Box. Further information can be obtained from the section "Rack Monitor Interface Chassis Specifications".

The electronics in the racks are protected through use of the Rack Monitor Interface which controls the interlocked AC outlets of the AC Distribution Box and provides a TTL high enable voltage to the power supplies, which is brought low upon detection of a fault, thus disabling the power supplies.

INTERLOCK SENSORS

Sensors used in the BLS racks are drip detectors, fan sensors, flowmeters, and smoke detectors. The sensors are connected to the RMI via the sensor cable. (See appendix A)

Drip Detectors

There are 3 drip detectors installed in the BLS power supply racks, located at the left, right, and rear of the racks. The left and right racks have drip detectors installed at the left, right, and rear of the racks, and in the air plenum. The drip detectors used are printed circuit boards with multiple traces in close proximity to one another. The drip detectors are interconnected to effectively form 1 drip detector. (See appendix B - D). The RMI detects any significant change of resistance between traces, and also detects broken cables.

Flowmeters

There is a flowmeter installed at the inside top of each rack, in series with the return manifold. Only the supply of the left rack and return of the right rack are in use, as the heat exchangers and power supply water are connected in series. Therefore, only the right rack's flowmeter for each set of BLS racks are used. The flowmeter produces an output of frequency and amplitude proportional to the flow rate through the meter. The RMI converts the signal to a GPM display, and monitors for flow rates below the RMI's preset value.

Fan Sensors

The racks to the left and right of the power supply racks have cooling fans. A DC proximity switch is used to sense the rotation of the fan. They are installed on the side of the chassis of the blower, and sense the passage of 4 bolts that are mounted on the rotating blower. (See appendix E)

Smoke Detector

The racks to the left and right of the power supplies have photoelectric type smoke detectors. The RMI provides the detector with a +20 volt supply. The output of the smoke detector is an open collector of an NPN transistor in series with silicon diode. The transistor is made to conduct in the presence of smoke by the internal electronics of the smoke detector. The RMI senses the transistor's on state, and produces an alarm.

INTERLOCKED FUNCTIONS

Power Supplies

The output of the power supplies are enabled/disabled by a TTL voltage level from the RMI. The following conditions will disable the power supplies in a given row of racks:

* Water flow through at a rack falling below the trip point set at the RMI. Note: the RMI's that monitor flow are in racks PN02, PN05, PN09, PN10, PN11, PN13, PC02, PC07, PC18, PC23, PS02, PS04, PS07, PS10, and PS13.

* The sensing of smoke by any of the smoke detectors in the row.

* The sensing of a stalled fan in any of the racks in the row.

* The sensing of a water leak in any of the racks in the row.

Water Solenoid

Each BLS rack in the North, Central, and South platform originally had water solenoids in each rack. They have been removed in favor of a slow-closing solenoid on the West side of the end of each row of racks. This solenoid controls the water for an entire row or racks.

The water interlock normally closed contacts of the RMI for each row of racks have been chained in series. A small box located in the power supply rack of each BLS rack set accomplishes this function. The slow closing solenoid is energized by the "right water" interlocked outlet at the West end of each row. The outlet is controlled by the water normally closed contacts of the RMI's in that row.

The sensing of the presence of a water leek in any of the racks in a given row will cause the solenoid for the row the close.

Cooling Fans

The AC power to the fans are provided by an interlocked outlet at the AC distribution box in the power supply racks. The outlet is controlled the normally closed fan interlock at the

RMI in the rack that the fan is located. The sensing of the presence of smoke in a given rack will cause that racks fan to stop.

Firus

The RMI provides a normally open relay contact which closes upon detection of smoke, water, or power loss to the RMI. If any of the aforementioned conditions exist in a given rack, a Firus advisory alarm for the row that the rack occupies is produced.

INTERCONNECTION CABLES

1553 Cable

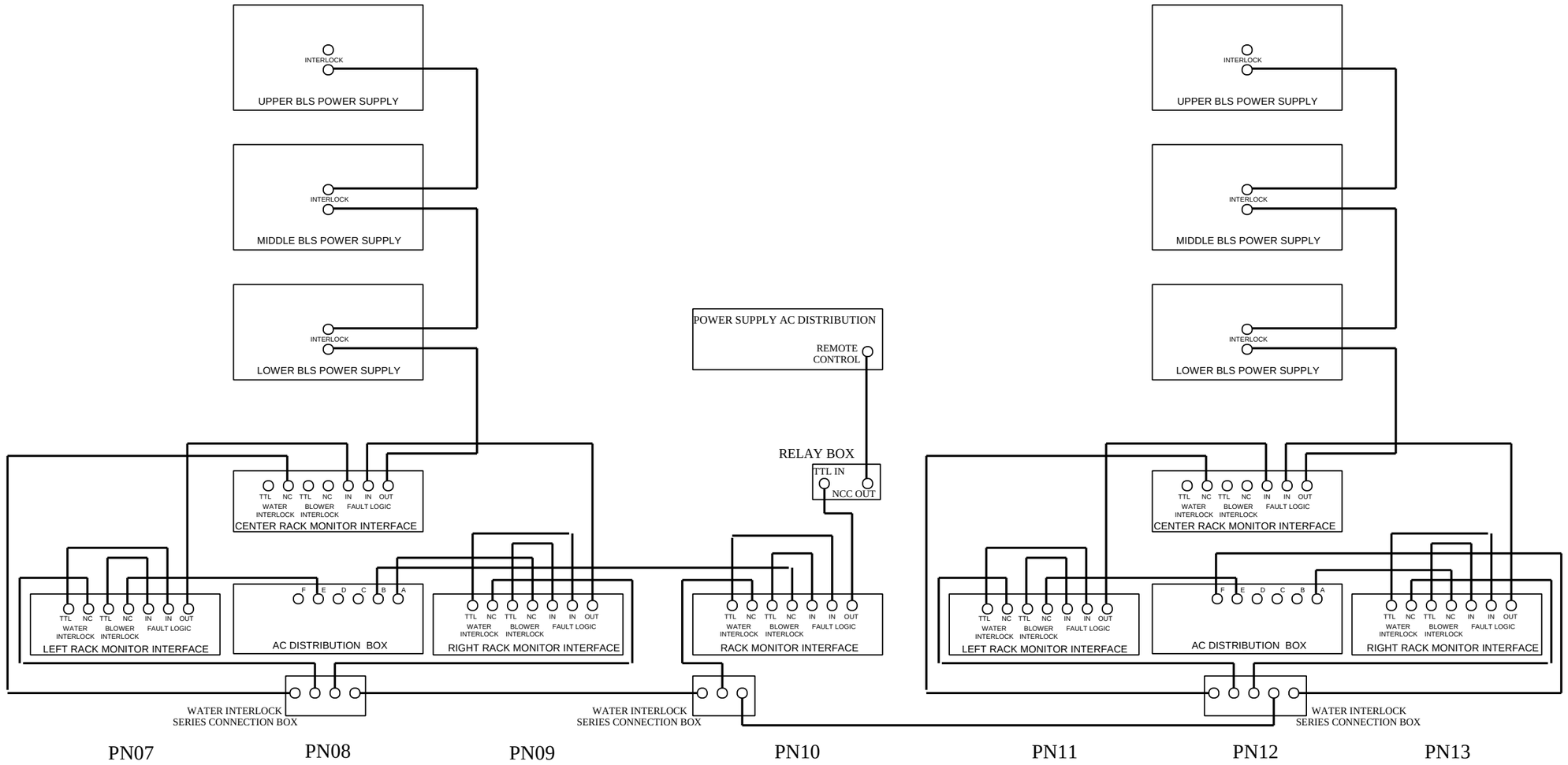
The Rack Monitor Interface presents rack status information in a digital format to the 1553 Rack Monitor, and accept a remote reset from the 1553 Rack Monitor. These status and control outputs of the RMI are connected to digital input P7 and digital output P8 of the 1553 Rack Monitor via 2 37 conductor flat ribbon cables. For more information, see "Dzero Rack Monitor Interface Specifications".

Fan and Water Interlock Cables

The RMI controls the interlocked AC fan and water outlets of the AC Distribution Box in the center rack. The connections are made via an RG58 A/U coax cable terminated on both ends with a male BNC. See fault logic diagrams in the back of this document for further details.

Fault Logic Cables

A fault in the left or right rack forces a fault to the center rack that enables the power supplies. Thus, any fault in any of the 3 racks will disable all 3 supplies in the center rack. See the fault logic diagrams in the back of this document for further details.



AS VIEWED FROM FRONT

WEST →

← EAST

Rev Date 1/8/92